3
Sampling & quantization

$f(x,y) = $ Image

<u>Sampling</u> : the process of digitizing the spatial احداثيات
Coordinates (x,y)

<u>quantization</u> : the process of digitizing the amplitude

(& intensity Level) values.

0 1 2 3 4 - - - 255

Image Representation
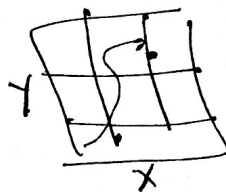
— Surface (3-<u>D</u> image)

image where two dimension represent spatial Coordinates (x,y)

and the third dimension is the f
intensity Level.

—<u>Image for human</u>
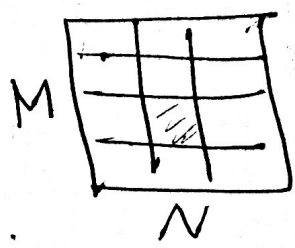
2-D image

Used by human
To <u>see objects</u>.

— <u>Array images</u>   (used in algorithms)

the image is <u>represented</u> as matrix of f values

k-bit image

bit k ٱلـ ٻ ﻋﻧﺪﻩ pixel ﻛﻞ

$L = 2^k$: no. of intensity levels,

ﻣﺜﺎﻝ e.g 8-bit $\Rightarrow$ 256 Level

| Dynamic Range = | $\dfrac{\text{Max intensity Level}}{\text{Min intensity level}}$ | ﻗﺴﻤﺔ |

Contrast = Max intensity Level . — Min intensity Level

ﻣﻌﻨﺎﻩ ﺍﻳﻪ؟ ﻓﺮﻕ ﻋﻦ ﺍﻟﺼﻮﺭﺓ؟

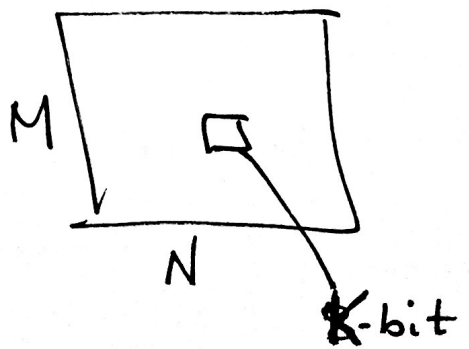max intensity is Controlled by saturation ﺗﺸﺒﻊ

Min intensity Level is Controlled by noise

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image ~~size~~ Storage

$$b = M \times N \times K$$

b $\downarrow$ Storage of image by bits

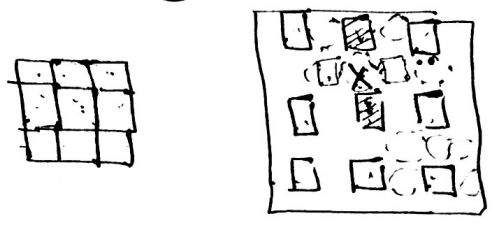K $\searrow$ no. of bits for each pixel

M

N

K-bit

.atial resolution no. of pixels per unit distance.

(DPI)

intensity resolution: no. of bits used to quantize intensity.

no. intensity $= 2^k$

Interpolation: is the process of using known data to estimate values of unknown location.

Resizing تصغير او تكبير الصورة

Types of interpolation:

① nearest neighbor interpolation

it assigns to each new location the intensity of its nearest neighbor in the orginal image.

(produce Bad results (pixeled images))

② bilinear :

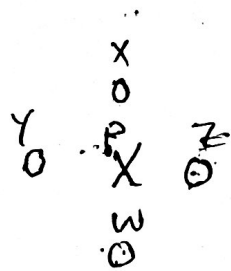use the 4 nearest neighbors to estimate the intensity at a given location

(give better results)

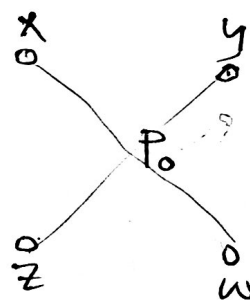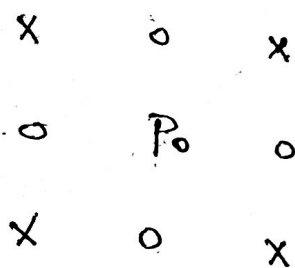③ bicubic which involves the 16 nearest neighbor of a point.

(Best results)

neighborhood & adjacency

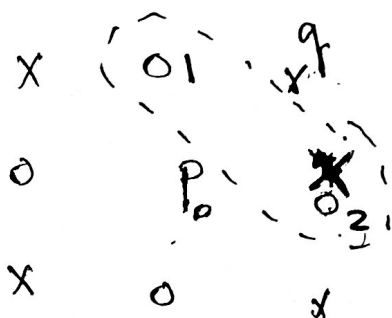$$\text{الجوار الأربعي} = N_4(p) = \{x, y, z, \omega\}$$

$$N_8(P) = N_4(P) \cup N_D(P)$$
الجوار الثماني

$$\text{الجوار القطري} \quad N_D(p) = \{x, y, z, \omega\}$$
Diagonal قطر

$$v = \{5, 6, 10\}$$
$$\downarrow$$
List of intensity

$$N_m(p) \Longrightarrow N_4(p) \Longrightarrow x \in N_m(p)$$
$$\text{or} \quad \longrightarrow N_D(p) \text{ iff } N_4(p) \cap N_4(q) = \phi$$

Sensors : to Capture أمواج Images

[1] Single Sensor

□
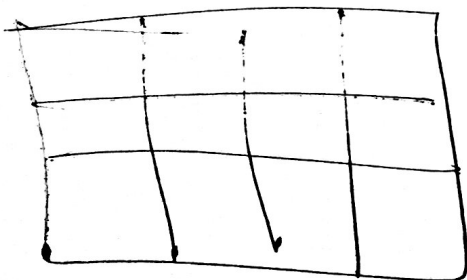
both x. & y dimension are Controlled by Mechanical movement.

[2] Sensor Strip

- one dimension is Controlled by mechanical Movement
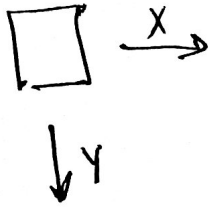- the other direction is Controlled by the no. of sensors on the strip.

[3] Sensor Array
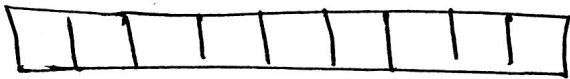

- no mechanical Movement
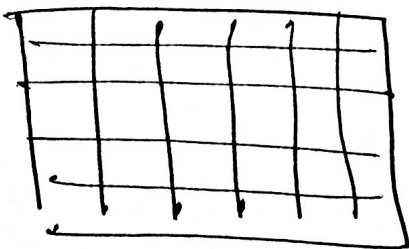
image aCquisition

1 Single Sensor

both x & y dimension is Controlled by mechanical movement.

2 Sensor Strip

— one dimension is Controlled by the number of sensors

— and the other dimension is Controlled by mechanical movement.

3 Array Sensor

— No mechanical Movement

— two dimensions of image are Controlled by number of pixels in the 2-D array.